Exploring Wildland Fire

Educator's Guide

Bureau of Land Management

Share the Adventure!

November 2002

Electronic Field Trip

U.S. Department of the Interior
Bureau of Land Management

Copies available from:
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Grades 4-9

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Welcome

Dear Educator:

It is our great pleasure to welcome you and your class to Share the Adventure! Exploring Wildland Fire.

The Bureau of Land Management (BLM) is bringing you this year's satellite broadcast to help you and your students better understand fire science and the challenges of managing wildland fire. BLM, an agency of the U.S. Department of the Interior, manages 106 million hectares (262 million acres) of public lands, located mostly in the Western States and Alaska. Each year, wildland fires have a major impact on BLM lands and on BLM's mission to sustain the health, diversity, and productivity of those lands for the present and the future.

Our 1-hour, live, interactive satellite broadcast is intended to be informative and fun. Student hosts in Arizona, Florida, and Idaho play a major role. As with many of our programs, education is our first priority. Each component of the broadcast and the educator's guide supports specific learning objectives that are tied to national education standards.

During the broadcast, your students will have an opportunity not only to visit sites around the country but also to hear from young people who have experienced wildland fire near their homes. They will meet smokejumpers, who risk their lives fighting fires, and homeowners who have learned the importance of being "FireWise." Perhaps most importantly, your students will be able to talk with fire specialists and scientists who study wildland fire—its behavior, its risks, and its benefits.

We hope you encourage your students to call in and talk to our fire experts. And we thank you for allowing them to take part in this special program.

Sincerely,

Kathleen Clarke
BLM Director

An Electronic Field Trip: Bring the World to Your Classroom

An electronic field trip is a distance learning event. It allows students to see and interact with people and environments that are far away at virtually no cost to the school. In this case, the field trip will take students to several locations:

- **Colorado**, where students will relate their experiences with a nearby fire in the summer of 2002 and work with homeowners to improve the chances that their homes won't burn;
- **Florida**, where The Nature Conservancy uses prescribed fire to improve habitat for wild life and to reduce fuels near housing developments;
- **Arizona,** site of a major fire in the summer of 2002 as well as the location of BLM's Na tional Training Center in Phoenix; and
- The **National Interagency Fire Center** in Boise, Idaho, where government agencies work together to coordinate efforts to manage wildland fire and to protect lives, property, and natural resources from fire.

This is all done through a live satellite television broadcast. This 60-minute instructional program supports the learning objectives and national education standards outlined on the following page. While geared for the middle school student, the broadcast should be of educational value and interest to students at all levels of learning.

Question and answer periods during the broadcast will provide students with the opportunity to interact with scientists and fire specialists via phone and fax. An additional 30-minute bonus session following the 1-hour show will offer extra time for interaction for those whose schedules permit.

Learning Objectives

After participating in the broadcast, viewers will be able to:

1. Describe three benefits of wildland fire and identify an example of a species that is adapted to fire.

2. Define the term "prescribed fire" and explain one or more benefits of prescribed fire.

3. Name three components of the fire triangle.

4. Describe three variables that determine fire behavior.

5. Identify at least three characteristics of a fire-wise structure or setting.

6. Describe an example of how communities and government agencies work together to manage fire.

7. Describe at least one action individuals can take in their community related to fire management.

8. Identify three careers related to fire management.

National Education Standards

The broadcast and the materials in this guide align with the following National Science Education Standards:

Content Standard B: Physical Science
Properties and changes of properties in matter; Motions and forces

Content Standard C: Life Science
Regulation and behavior; Populations and ecosystems; Diversity and adaptation of organisms; Matter, energy, and organization of living systems

Content Standard E: Science and Technology
Understanding about science and technology

Content Standard F: Science in Personal and Social Perspectives
Changes in environments; Natural hazards; Risks and benefits; Science and technology in society

How to Use This Guide

This guide includes several suggested readings and activities for you and your students to do before and after the broadcast. The readings are primarily designed to give students some contextual background before the broadcast. Depending on the reading level of your students, you may want to make copies of these pages to hand out, read them aloud, or read them in advance and summarize the contents for your students. The suggested activities provide you with a variety of ways to enhance the learning experience in the classroom. Most are designed as hands-on activities, but they could also be performed as demonstrations. (For the activities that involve the use of matches and fire, we strongly recommend that these be done as demonstrations.) Some can be accomplished easily within the class period, while others will take more time. We encourage you to choose activities that match your students' interests and abilities and complement your lesson plans.

We want to hear from you!

The guide also includes an evaluation form. Please be sure to complete the form and return it to us. This will help us design future programs targeted to your needs. The first 100 educators to complete and return the evaluation form will receive a CD on fire and fire management entitled "Burning Issues." This interactive multimedia program, which sells for $25, uses dynamic video, more than 300 photos, and engaging activities to help students learn about the role of fire in ecosystems and the use of fire in managing natural resources.

Share the Adventure: Tips and Technology

Date

Thursday, November 7, 2002
See broadcast times on **next page.**

How to Participate in the Program

Anyone with a C-band satellite dish can participate in the program. You will need access to the satellite receiver, a monitor, and—if you want to tape the show for future use—a videotape recorder.

The program will also be broadcast on RFD-TV, a cable channel available through DirecTV channel 379 or DISH Network channel 9409.

There are no restrictions on rebroadcasting. For interactive participation, you will need either a phone or fax machine.

If You Don't Have a Satellite Dish

Many cable companies, school systems, school districts, district or regional media centers, or State educational television stations have access to a C-band satellite dish and may be able to provide your classroom with the program through an internal cable channel. Check with them early. You will need to provide the satellite coordinates listed on the next page.

Television Receiver

Plan your setup before the day of the event. Check the technical information page for the satellite coordinates. Tune in the satellite and make sure you can receive the satellite listed. Check to see that all other equipment is working properly. You may want to use more than one television depending on the number of viewers. For large groups, a projection TV is recommended.

Plan to Interact with Us

Make sure you are ready to participate via phone or fax. Check all equipment the day before the event. Place the phone in the back of the room away from the TV. An operator will answer your phone call. When the operator indicates that you are live on the air, turn your television volume down to avoid feedback. Wait for the host to ask for your question.

Broadcast Coordinates and Times

Satellite Coordinates

Transmission	Satellite	Location	Channel	Polarity	Frequency
C-Band	Galaxy 3	95-degrees W	2	Vertical	3740 MHz
DirecTV			379		
DISH Network			9409		

Time Zone Reference for First Broadcast

Time Zone	Test Signal	Program Starts	Program Ends	Bonus Ends
Hawaiian Standard Time	5:30 am	6:00 am	7:00 am	7:30 am
Alaskan Standard Time	6:30 am	7:00 am	8:00 am	8:30 am
Pacific Standard Time	7:30 am	8:00 am	9:00 am	9:30 am
Mountain Standard Time	8:30 am	9:00 am	10:00 am	10:30 am
Central Standard Time	9:30 am	10:00 am	11:00 am	11:30 am
Eastern Standard Time (incl Puerto Rico)	10:30 pm	11:00 am	12:00 N	12:30 pm

Time Zone Reference for Second Broadcast

Time Zone	Test Signal	Program Starts	Program Ends	Bonus Ends
Hawaiian Standard Time	8:00 am	8:30 am	9:30 am	10:00 am
Alaskan Standard Time	9:00 am	9:30 am	10:30 am	11:00 am
Pacific Standard Time	10:00 am	10:30 am	11:30 am	12:00 N
Mountain Standard Time	11:00 am	11:30 am	12:30 pm	1:00 pm
Central Standard Time	12:00 N	12:30 pm	1:30 pm	2:00 pm
Eastern Standard Time (incl Puerto Rico)	1:00 pm	1:30 pm	2:30 pm	3:00 pm

By reviewing the "Meet the Players" section of this guide in advance, students will learn who is who. This will help them decide to whom they should direct their questions. Encourage students to make each question as clear and brief as possible, and to ask one question at a time.

Videotaping the Broadcast

If you are unable to view the live broadcast, we encourage you to tape and use the program in future lessons. You may also rebroadcast this program over the school cable system. We will have a limited number of copies available for schools that are unable to tape the broadcast. Contact us through our web site *(http://www.blm.gov/education/LearningLandscapes/teachers/fieldtrip/)* to obtain a copy.

Visit Our Web Site

This guide, an evaluation form, and additional information on BLM's education programs are available on our web site at *http://www.blm.gov/educatio*n. This site also includes links to other web resources.

Interactivity

During the telecast, students and teachers may phone in questions. The toll-free number is:
1-877-862-5346

Student questions will also be accepted by FAX:
FAX numbers (caller pays): 602-906-5701 and 602-906-5702

The local Phoenix metropolitan area call-in number is: 602-943-2279.

Why Study Wildland Fire?

During the year 2002, serious, large wildland fires affected many parts of the United States. A very dry spring and summer combined with massive fuels buildup in many areas created unusually large fires in many places. Although the number of wildland fires was actually lower than average this year, some 2.8 million hectares (7 million acres) burned, mostly in the western United States. As a result, the 2002 fire season now ranks as the second largest in the past 50 years.

Many people were affected by the 2002 fires. In fact, over the past several years, many people have lost their homes to wildland fires. And too many firefighters have lost their lives. In dealing with fire anywhere, keeping people safe is the primary goal. But in recent years, we have come to recognize that fire is part of a balanced wildland environment. As more people move into wildland areas—particularly as the population of western states continues to grow—the challenges of dealing with fire become more complex.

Fires are part of the natural process and will continue to burn, but people's homes can be made safer. Learning about FireWise protection measures is just one reason for participating in this broadcast. You and your students will also learn more about the role of fire in nature and find out about some plant and animal species that actually depend on fire to survive. You'll be able to see firsthand some of the consequences of excluding fire from areas that depend on it. When fires don't burn where they are needed, fuels in the form of dead trees and brush tend to build up. The result is often a catastrophic fire, such as the one that affected a large area of Arizona in 2002. You'll visit the site of the Rodeo-Chediski fire, where some 200,000 hectares (500,000 acres) burned.

Preventing catastrophic fires is the main goal of fuel reduction efforts. There are several ways by which fire specialists reduce the amount of fuels in a particular area. Prescribed fire, a fire intentionally set by professionals under carefully controlled conditions, is one tool. Mechanical methods include cutting down trees and removing brush. Biological means are also used, including the employment of goats, sheep, and other grazing animals, as well as insects. Scientists continue to study which methods—or combination of methods—work best in which situations.

This is just one of many complex issues that the broadcast will address. Students will come to realize why fire management is a very complex task. They will gain a clearer view of the risks and benefits involved in some of the difficult choices that must be made. And in the next few years, as they become active participants in the decision-making process, students will be better able to make informed choices.

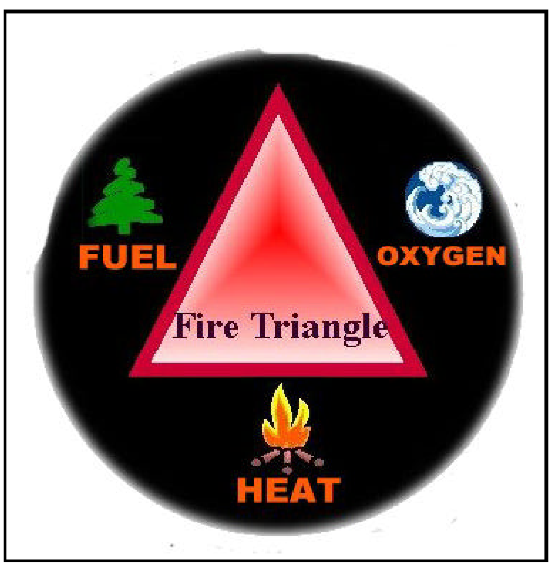
What is Fire?

Fire is a chemical reaction that requires the presence of heat, fuel, and oxygen—the "Fire Triangle." Fire is the chemical process that involves the rapid oxidation of combustible materials (any substance that will ignite and burn) accompanied by the release of energy (heat and light).

In order for combustion to occur, heat, fuel, and oxygen must be present. Air supporting a fire must be at least 16 percent oxygen; the air we breathe has about 21 percent oxygen.
Fuel is any material that will burn. In order to react with the oxygen, the fuel must be in a gaseous state. Heat from the fire's ignition decomposes solids and liquids, releasing the flammable gases that burn. A chemical chain reaction sustains the fire.

The goal of firefighters—whether they are fighting a fire in a building or in a forest—is to reduce or eliminate one or more elements of the fire triangle. By using water, firefighters reduce the heat of a fire. Digging a line around a fire—creating a "firebreak" —removes fuel. And covering a fire with a fire-retardant chemical—a thick, soupy substance—blocks access to oxygen.

Fuel and heat are directly related. Generally, the more fuel, the larger the fire, which generates more heat. The more heat, the more rapidly the fire will spread. With intense heat and adequate fuel, fires perpetuate themselves, even to the point of creating their own winds, in essence "fanning their own flames." Whether it's natural wind or wind generated by the fire itself, this fanning of the flame carries fresh oxygen to the fire and the intensity of the fire "preheats" nearby fuels.



Activity:The Fire Triangle

This activity aligns with the following National Science Education Standard:
Content Standard B: Physical Science—Properties and changes of properties in matter

Materials needed

Three candles (small votive-type candles work well)
One medium-size and one large heat-resistant glass jar
Aluminum foil
Matches/lighter
Fire extinguishers
Safety glasses
Insulated hand mitten/oven hot pad
Fire safety/lab rules posted

Procedure

1. Cut the wicks on each candle so that they are the same length
2. Place the candles on the foil on a flat, sturdy surface.
3. Light each candle. Place the two jars firmly over two of the burning candles. Leave one candle burning in the open.
4. Discuss which candle burns the longest time and which burns the shortest time. Challenge students to explain why. (The candle in the open had a continuous supply of oxygen, while the candle in the small jar had the least oxygen and therefore burned out first. The larger jar contained more air (oxygen) and thus burned longer than the candle under the smaller jar.)
5. Have students suggest ways that firefighters can deprive fires of oxygen. (Spraying the fires with foams or other fire retardants.)

Extension

Knowledge about the fire triangle can also help students understand why it is important to “stop, drop, and roll” if their clothes catch on fire. Ask students to explain how this helps to break the fire triangle. Conversely, using their understanding of the fire triangle, ask them to explain why it’s not a good idea to run if their clothes were to catch on fire.

Fire's Natural Role: Fire Ecology

Fire is dangerous and powerful. From an early age, children learn never to play with matches. And rightly so. Fire does pose a serious threat to human life and property.

But fire is a natural process—like precipitation and wind. Many plant and animal species have adapted to—and even benefit from—wildland fire. Trees in fire-prone areas often have thick bark that insulates their inner tissues from heat. Giant sequoias, ponderosa pines, and longleaf pines are a few examples of trees with thick, insulating bark. Smaller shrubs and plants may have long roots that are able to produce new growth even if the above-ground parts of the plants are burned.

Although animals may occasionally be trapped in a fire and killed, most are capable of either fleeing or, in the case of burrowing animals, moving deeper underground, to escape the effects of fire. Deer, elk, and bear, for instance, can usually outrun a fire and escape. Mature birds, of course, can fly away. And a variety of animals, including mice, snakes, and lizards, can use burrows to escape the flames.

Some plants that live in fire-prone areas have adaptations that help to ensure the survival of the species in that area. Certain pines, for instance, have what are called serotinous cones, which are held tightly closed by a sticky resin. When the cones are exposed to the heat of a fire, the resin melts and large numbers of stored seeds are released. The lodgepole pine in the West and the sand pine in the East are two examples of trees that have serotinous cones. Such fire-adapted trees are quick to reseed an area that has been burned.

Fire: An Agent of Change

Ecosystems are constantly changing. In any natural community, a series of slow changes takes place over time. This process is called succession. Different plants and animals have different needs. Some plants need bright sun to grow well, and certain animals rely on these types of plants. Other plants can survive in areas of deep shade. These plants may support different species of animals. As trees grow larger, an area that once was an open field may become a forest.

Did You Know?

Pine trees are not the only plants that are adapted to fire. Peter's Mountain mallow, a plant found in only one small area of southwestern Virginia, was listed as an endangered species in 1986. By 1991, the mallow's population had declined to just three plants. Scientists researching the plant discovered that the plant's hard seed coat was not opening, which prevented germination. Much like popcorn, the seed coat can be broken by the heat of fire. Now, The Nature Conservancy, which protects the habitat of the mallow, is regularly using prescribed fire to encourage germination and to reduce the populations of other plants that might shade or crowd out the mallow. Today, the population of Peter's Mountain mallow averages about 50 to 70 plants at any given time.

Fire plays a role in the succession of many ecosystems. For thousands of years, lightning-caused fires have occurred on a regular basis across broad sections of our country. In fact, millions of hectares in the United States today consist of what are called fire-dependent ecosystems. These areas need periodic fires to maintain the natural balance of vegetation and wildlife.

In forests, for example, fire creates openings that allow seeds to sprout in sunlight. Fire also recycles minerals from plant materials into the soil, which other plants can use as nutrients. In addition, fire clears out undergrowth, destroys insect infestations, kills diseases, and helps to improve wildlife habitat.

In the plains and prairies of the Midwest, fire has historically played an important role as well. Grasses and shrubs came to depend on fire, which naturally occurred about every 35 years. Fire stimulates new growth in prairies, and many animals fare better on rejuvenated vegetation created by fire. Fire also can check the growth of invasive species and remove woody plants in grasslands, keeping the grasses from being shaded out by the larger plants.

The chaparral regions of California and the Southwest are also dependent on a regular cycle of fire. Some plants in these areas contain flammable oils and resins in their leaves, encouraging the spread of fire. Their seeds, on the other hand, are extremely fire-resistant. Fire thus promotes the constant regrowth and rejuvenation of chaparral communities.

Fire, floods, and other natural disasters can produce dramatic change in a short period of time. Even fire-dependent ecosystems can be damaged by an extremely intense fire. After such a severe fire, the land may take years to recover. But the process of succession does usually occur, most often in several stages. In the first stage, plants called pioneer species begin to grow. In a recently burned forest, for instance, grasses and wildflowers may be these "pioneers," the first plants to establish themselves. For a few years, they may be the only plant life visible. Seeds of larger plants—blown in by the wind or carried by animals—will take root. So will the seeds of some of the trees that were there before. Over time, shrubs and seedlings of young trees will grow up in the area. Gradually, the trees become larger and the forest begins to resemble the forest that burned years before.

Activity: Please Release Me! Seeds and Fire

This activity aligns with the following National Science Education Standards:
Content Standard C: Life Science—Regulation and behavior; Diversity and adaptations of organisms

Pine trees have needle-like leaves and produce seeds in cones. Some pine species that store their seeds in resin-sealed cones rely on the heat of fire to melt the resin and release the seeds. Encourage your students to explore a nearby wooded area, where pine trees grow. Have them try to find different types of pinecones—some open and some closed. With some pinecones, the seeds are released as the cone dries out or decomposes. But with other cones, it takes the intense heat of a fire to release the seeds.

Materials needed

(Ideally there would be enough for each student to perform his or her own demonstration. For younger students, this activity should be performed as a demonstration, since it involves the handling of hot water.)

Collection of serotinous pinecones (e.g., from lodgepole, jack, whitebark, or sand pines)*
Aluminum pie tins (about 20 cm in diameter)
Paper plates
Spoons
Boiling water
Paper towels
Safety goggles

*You can obtain these from some scientific supply companies (look up under “serotinous”), or you could check with a local naturalist to see if any of these can be found in your area.

Procedure

1. Distribute at least one tightly sealed pinecone to each student. Point out to the class that pinecones are the seed-bearing parts of a pine tree. The cones have to open up in order for the seeds to be released.
2. Ask students for ideas on how the closed pinecones might open up in nature. (Getting rained on, being crushed or consumed by animals, and drying out are just a few possibilities they might suggest.) Write these ideas on a chalkboard or pad of easel paper. (If it’s not on the list, prompt students to suggest “heat” or “fire.”) Challenge students to come up with suggestions on how they could test some of their ideas.
3. To test for heat, first place pie tins on flat, stable, uncluttered surface.
4. Carefully pour boiling water into the pie tin.

Activity: Please Release Me! Seeds and Fire (continued)

5. Using the spoon, gently place the pinecone into the water for about 20 seconds. Look and listen. (You should see tiny bubbles and hear popping noises as the hot water melts the resin and expanding air comes out of the cone.)
6. Place the cone on a paper towel and leave it in a warm, dry place overnight.
7. Shake and tap each pinecone over a paper plate to catch the seeds. If they don't come out easily, roll the cone back and forth on the paper plate.
8. Look for "filled" seeds, which have a rounded, brown lump attached to the papery wing. Filled seeds contain a tree embryo—the beginning of a new tree.
9. Have each student count the number of filled seeds that his or her pinecone produced. Perhaps the class could create a chart or graph displaying the results of their pinecone production.
10. Discuss some possible reasons for the variation in number of seeds produced. (Possible answers include location, soil, weather, genetics, chance, and skill of the student in extracting the seeds.)

Activity: Living with Fire

This activity aligns with the following National Science Education Standard:
Content Standard C: Life Science—Diversity and adaptations of organisms

Many plants and animals have adaptations that allow them to live in fire-dependent ecosystems. In this activity, students can create their own plant or animal that is adapted for fire survival.

Materials needed

Paper and pencils
Crayons or markers

Procedure

1. Review some of the preceding background information with your students. If possible, cite some plants and animals from your area as examples of species with adaptive strategies to survive fire.
2. Ask each student to design a fictitious plant or animal that has adaptations for fire survival. Have each student draw the plant or animal and give it a name.
3. Once their creations are done, students should explain how their plant or animal is adapted for a fire community.

Activity: Close to Home—Succession in Your Region

These activities align with the following National Science Education Standards:
Content Standard C: Life Science—Regulation and behavior; Populations and ecosystems; Diversity and adaptations of organisms

Encourage students to explore the process of natural change in your community. The first step is finding a natural area. Once your place has been located, the next step is to research possible sources of information on the changes that have taken place there over the course of the last 50 years, 100 years, and possibly longer. Perhaps longtime residents of your community have memories of what the area looked like in the past. Or maybe the local library has histories of the area that include photographs or descriptions. What evidence of natural succession can you discover? What changes have come about as a result of human activities?

Fire in Your Region?

Do you live in or near a fire-dependent ecosystem? Are there any natural areas near you that have burned in recent times? If so, a field trip to one of these places could provide firsthand evidence of succession following such an event. Perhaps you could establish a program at your school in which students in a particular grade could take an annual trip to the area to monitor changes. To explore this possibility further, contact a local nature center or land management agency.

Plants and Animals and Fire

Whether or not you live in a fire-prone region, students might be interested in researching the effects of fire on a familiar plant or animal species. Encourage them to choose one species, conduct research, and prepare a report—illustrated, if possible—for the class. The report should cover such information as where their species lives, what its habitat needs are, and how fire affects it.

An excellent source for such information is this website from the U.S. Forest Service: http://www.fs.fed.us/database/feis/

Fueling Fire in Nature

Fuel for fire in nature can include both living and dead vegetation, organic subsurface material (such as peat and coal), and human-built structures. Whether or not these fuels burn—and how intensely they burn—depends on several factors, including the fuels' moisture content, size and shape, quantity, and the way in which they are spread over the landscape.

Live vegetation has more moisture than dead plants do. High moisture content slows the burning process, because heat from the fire must first dry out the fuel. The size and shape of fuel helps to determine its moisture content. Lighter fuels such as grasses, leaves, and needles can get rid of moisture quickly, so they burn quite rapidly. Large trees take longer to ignite. The size and shape of a fuel also affects how much of its surface area is exposed to the air. Increased exposure to air increases the amount of oxygen available to the fire. (Remember the fire triangle?)

The amount of fuels in an area is known as the area's "fuel load." Fuels may be distributed evenly across the ground, allowing a wildland fire to travel uninterrupted. Or they may be distributed unevenly, forcing the fire to travel over rocks or other barriers by means of wind-blown embers. How fuels are arranged vertically is another important factor in the spread of wildland fires. The main ground fuel is duff, the layer of dead, decaying plant material that makes up the top layer of soil. It contains decaying leaves and wood as well as roots. Surface fuels are found on or right above the ground and include grass, leaves, dead and fallen needles, dead wood, stumps, and low shrubs. Another category of fuels is known as ladder fuels. These consist of long grasses, brush, smaller trees, and lower limbs and branches of other trees. Aerial fuels are standing vegetation including branches, leaves, trunks (including dead trunks known as snags), and tree crowns—the tops of trees. Crown fires can burn independently of surface fires and move from treetop to treetop.

In the Absence of Fire

When fire is absent, fuels build up. The problem of fuel loads is one of the most troublesome issues that land managers have to face. Most of the catastrophic fires that occurred in 2002 were the result of a tremendous buildup of fuels over a long period of time. As mentioned earlier, many ecosystems depend on regularly occurring fires to stay healthy. Fires that occur in nature on a regular basis tend to burn close to the ground, clearing out fuels near the surface, but having little or no effect on the larger trees.

In areas where fuel has built up over a long time, fires can burn with great heat and intensity. They can spread quickly from the surface to the crowns, or tops, of trees, helped by an abundance of ladder fuels. Severe fires can burn the soil, almost baking it hard. Such baked soil is called hydrophobic soil: It repels water, creating the potential for serious soil erosion. Areas subjected to severe fires often do not recover quickly through the process of succession. Sometimes non-native species may invade the area and crowd out slower growing native plants. To prevent this, land management agencies frequently step in to speed the rehabilitation process along. They treat the soil and re-seed the area with native plants.

Activity: Fuels—What Burns Best?

This activity aligns with the following National Science Education Standards:
Content Standard A: Science as Inquiry—Abilities necessary to do scientific inquiry;
Content Standard B: Physical Science—Properties and changes of properties in matter

In nature, fire's fuel is plant material. The amount of moisture that plants contain plays a significant role in their ability to burn. Land that contains large quantities of dead trees and brush are particularly vulnerable to fire. So are regions that have experienced drought.

In the following outdoor activity, with the help of adult volunteers, students will be able to observe different types of plant material to see how likely they are to burn.
(Note: This activity should be scheduled for a day with little or no wind, when several adult volunteers will be available to help.)

Materials needed

Metal buckets - 6
Wooden matches - 42
An assortment of the following plant materials placed inside labeled bags or boxes:
*green leaves and needles (can be attached to small twigs)
*dead pine needles
*dead and dry branches (diameters less than 0.5 cm)
*dead and dry branches (diameters more than 0.5 cm)
*some partially burned material from a fireplace or campfire
Large bucket of water
Spray bottle
Access to a hose
Metal trash can (for disposal of materials after the experiment)

Procedure

1. Divide the class into six teams, each of which will be paired with one adult volunteer. Each team will assemble a mixture of fuels according to one of the recipes below. All fuels must fit inside the buckets, with nothing hanging out over the edges. Use only the fuels included in each recipe; nothing else should be added.
Fuel Recipes:
A. Green pine needles attached to twigs (Note: If these are gathered more than a day before the experiment takes place, they should be stored in a plastic bag in the refrigerator.)
B. Dead and dry branches—less than 0.5 cm in diameter—mixed with green pine needles
C. Small dead and dry branches (as in B) mixed with dry pine needles
D. Large dead and dry branches, mixed with small-diameter dead and dry branches
E. Same mixture as D but sprayed lightly with water
F. Partially burned materials from a campfire or fireplace

Activity: Fuels—What Burns Best? (continued)

2. Place the buckets on a designated surface of pavement or gravel, away from cars, buildings, and dry vegetation.
3. Using only the seven matches provided for each bucket, the adults should attempt to light the fuels in each bucket.
4. After 15 minutes, stop the activity.
5. As a class, take a tour of the buckets. Discuss how successful each fire was and why it burned well or did not.

Students will most likely note that it was difficult to ignite the "green" fuels and the fuels that had been sprayed with water. Challenge them to explain why. (They had more moisture than the other fuels. The heat from the flame first has to evaporate the moisture before it can ignite the fuel.)

Students might also note, however, that once the green fuels started burning, they actually burned quite well. Why? (They have plenty of stored energy—more, in fact, than dead plant materials. Pine needles also contain oils and other compounds that burn well.)

Have students compare and contrast the ability of large and small materials to burn. Why would the smaller pieces ignite more easily? (The smaller pieces have more surface areas exposed to the heat of the flame and to oxygen.)

Why would the material that had already burned be difficult to ignite? (Carbon compounds in plant materials combine readily with oxygen in the presence of heat. Charred wood from a campfire, on the other hand, has had much of its carbon burned off.)

Next, ask students to discuss what this experiment tells them about fuels in a wildland fire.

Adapted from "Bucket Brigade" in FireWorks--See Resources

Fire Behavior

The tremendous buildup of fuels and the extremely hot, dry weather that affected much of the nation contributed to the number of fires in 2002 and to the severity of many of the fires. There are, in fact, several factors that affect the way flames develop and fire spreads—fire behavior. They are:

- fuels
- weather
- topography.

Wind, temperature, and humidity all affect the behavior of wildland fires. Strong wind can push flames toward new fuel sources. It can also pick up embers, sparks, and other burning material and blow them toward new areas, creating what are called "spot fires." In addition, strong winds help to dry fuels faster, making them easier to ignite. The temperature of the air affects fuel temperature, which in turn affects how quickly or slowly fuels will reach their ignition point and burn. In the same way, humidity of the air affects the moisture level of the fuel, which also affects how quickly it will burn.

Fire can also create its own weather. It obviously raises temperatures in the surrounding area, but it can create wind as well. When hot air above the fire rises, fresh air rapidly moves in, producing more wind and oxygen for the fire—in effect, fanning the fire's flames.

Weather conditions can change often during the course of a fire. Humidity, for example, is usually higher at night, meaning that a fire may burn less intensely. During the day, sunlight heats the ground and warm air rises, allowing air currents to move up sloped landscapes. During the night, the ground cools and air currents travel downward. As a result, fires often burn upslope during the day and downslope at night.

While weather can change constantly during a fire, the topography of an area does not change. But it does affect the way fire behaves. So an understanding of different terrains and how they affect fire behavior can be a big help to firefighters. The amount of sunlight or shade, the temperature and elevation, the amount of wind and precipitation—all these play a role in the vegetation that can live in an area. Topography, therefore, affects the types of fuel that are likely to be available to a fire. The steepness of a slope can also contribute to how quickly a fire spreads. When a fire begins at the bottom of a slope, the fuels located uphill are heated by the rising air, helping them to catch fire more easily when they come in contact with the flames. Fires that begin near the top of a slope may deposit burning material further down, creating opportunities for more fires to begin at the bottom.

Scientists continue to study the way fire behaves. The more they know, the more they can help keep firefighters safe and the more they can help protect communities located in fire-prone areas.

Activity: Fanning the Flames

This activity aligns with the following National Science Education Standards:
Content Standard A: Science as Inquiry—Abilities necessary to do scientific inquiry;
Content Standard B: Physical Science—Transfer of energy

In the experiment on page 17, students discovered what happens when a fire is deprived of oxygen. The flame goes out. By using the same materials, along with a bowl of water, you can demonstrate to students how a burning fire can create its own wind.

Materials needed

Small candle (a free-standing votive candle or a small candle held upright by a piece of clay)
Heat-resistant jar
Bowl of water (Bowl also needs to be heat-resistant)

Procedure

1. Place the candle in the bowl and add enough water to cover about half the length of the candle.
2. Light the candle and carefully place the jar over the candle.
3. Observe what happens when the flame goes out.
4. Challenge students to explain what they observed.

When the flame goes out, the air inside the jar cools. Cooler air takes up less space than the previously heated air, which means that the air pressure inside the jar becomes lower than the air pressure outside the jar. The water rises inside the jar until the air pressures are equal inside and out.

In a wildland fire, atmospheric gases—primarily nitrogen—are heated and become lighter than the surrounding air. As this warm air rises and the air in the burned areas becomes cooled, fresh air flows toward the fire—in the same way that the water flowed up into the jar. The air—like the water—moves from an area of high pressure to an area of lower pressure.

Activity: A Matchstick Forest

This activity aligns with the following National Science Education Standard:
Content Standard B: Physical Science—Motions and forces; Transfer of energy

In this activity, you can create "forests" out of matchsticks and demonstrate to students the way in which slope affects the behavior of fire.

Materials needed

Kitchen matches (several boxes)
Modeling clay (potters clay is recommended to prevent melting)
3 large metal roasting pans
Spray bottles for water
Clock with second hand
Thermometer
Heat resistant oven mitt
Fire extinguisher
Safety goggles

Procedure

1. Firmly press a thin layer of clay, about 15 x 20 cm, into each of the three roasting pans.
2. Place the first pan flat on a stable surface. One end of the second pan should be elevated at an angle of 20 degrees, and the third pan should be elevated at an angle of 40 degrees. The first pan represents flat land, the second a moderate slope, and the third a steep slope.
3. Build a "forest" in each pan. Insert matches vertically into the clay, approximately 1 cm apart.
4. Assign one student to be the timer and a second to be the recorder.
5. On a signal from the timer, light one row of matches in one of the pans. You should light the row closest to the end of the pan at the bottom for the pans that are elevated.
6. The recorder should note the topography of the "forest," the density of the vegetation (the number of matches), the time of the burn, and the number of unburned trees.
7. Repeat steps 5 and 6 for the other pans.
8. Discuss the results. Which terrain promoted the most rapid spread of the fire? Why?

(Students should note that the matches/trees on the steepest slope burned most rapidly because heat rises and since they are "preheated," the matches uphill ignite more easily.)

Activity: A Matchstick Forest (continued)

Extensions:

If time permits, you could use additional matches to explore other aspects of fire behavior. For instance:

- Increase and decrease the density of the trees (matches) in their matchstick forest.
- Light matches at the top of the steep slope instead of the bottom.
- Cut some of the matches in half and, using the top parts of the matches, create a forest with trees of different heights.
- Spread the bottom parts of the cut matches on the forest floor to simulate the presence of fallen tree trunks.
- Blow gently on the matchstick forest to see how this affects the spread of the fire.

As you proceed through each of these demonstrations, encourage students to explain the fire behaviors they observe.

Try This!

On Location: Colorado

During the broadcast, students from Nucla High School in Colorado report on their firsthand experience with a wildland fire in Burn Canyon during the summer of 2002. Have your students locate Nucla on a map. Using the Internet or other research materials, have your students investigate the kind of terrain they might expect to find in this area. What types of vegetation might be found there? Next have students gather information on weather in the region. Was there much snow during the previous winter? What about rainfall in the spring? How would these factors affect the behavior of the fire in Burn Canyon?

(Note: A good place for students to start their search for information is the web site of the U.S. Geological Survey: www.usgs.gov)

Fire History

Fire has been part of Earth's history for millions of years. Many scientists believe that fire developed along with the evolution of the atmosphere and the earliest terrestrial vegetation. Fire has also been an important part of human culture for some 500,000 years. It was probably the first product of nature that humans learned to control. In many parts of the world, including the United States, native peoples have seen fire for the natural force that it is and have used it as a tool.

Native Americans used fire to kill and collect insects for food and to improve hunting. They would cut down trees and use fire to clear the land of vegetation so they could plant crops—a practice known as "slash and burn" agriculture. In the east, for example, tribes used fire to maintain the Shenandoah Valley as grassland. Buffalo, traditionally a western species, actually moved into the eastern grasslands created by fire. European settlers reported seeing Native Americans using fire to herd deer onto peninsulas, where they could be hunted from canoes. Grassland corridors created by fire also made travel easier. And fire was frequently used as a weapon of war against neighboring tribes.

At first European settlers adopted many of the same techniques used by Native Americans. They also practiced slash and burn agriculture, settling for a while in one place and then moving on when the land became worn out and crops began to suffer. But as the number and size of communities began to increase, fire became more of a threat than an aid to progress.

In the 1800s, wildfires burned large areas of the country. In 1825 during a drought in the north-east, loggers ignited a fire that burned out of control, blackening more than 1 million hectares (3 million acres) in Maine and New Brunswick, Canada. During the summer of 1871, a wildfire killed 1,300 people in a single night in the town of Peshtigo, Wisconsin. Such incidents as these, while rare, led to the development of more active fire suppression efforts.

A national fire prevention campaign became part of this effort after World War II. Smokey Bear was enlisted to remind everyone that "only you can prevent forest fires." Smokey's message, still a valuable one today, was aimed at people who cause fires through carelessness or malice. But it reflected an attitude that prevailed for some 100 years. All fires were considered bad. In many cases, even natural fires, such as those started by lightning, were vigorously fought.

The result of this long period of fire exclusion has been the buildup of huge quantities of brush and small trees as well as dead and dying trees in many areas. In places where fuel loads have accumulated for years, fire can be extremely intense and destructive. Severe fires can damage ecosystems for decades or even longer and pose a greater threat to homes and communities. Experience with such destructive fires, coupled with the growing realization that fire can be beneficial, has led fire specialists to reevaluate policies that called for suppressing all fires.

Today, dealing with fire involves much more than fire prevention and fire suppression. Fire "mitigation" is a new piece of the puzzle. Mitigations are actions taken before an event to reduce or limit losses. The two primary components of fire mitigation are education and fuels management. In the first process, fire managers work with individuals and communities to educate them about how they can reduce losses to their homes, neighborhoods, and communities. The second part of fire mitigation is fuels management—removing or changing the type or amount of fuel in an area. The key to fire mitigation is that the actions must be taken *before* the fire starts.

Fuels Management

Fuels management involves removing fuels and changing the types of fuels that exist in a particular area. Several methods are available to control fuels:

- Mechanical treatment involves physically removing brush, trees, and other debris;
- Biological treatment relies on animals, such as sheep, goats, cattle, or insects to consume plants in an area; and
- Prescribed fire is the intentional setting of a fire under carefully controlled circumstances.

Each of these methods has advantages and disadvantages, and there is no one method that can be applied in all areas. In fact, a combination of treatments often works best. Scientists continue to study fuel control methods, and land managers continue to work with communities in an effort to make the best possible choices in any given situation.

Try This!

On Location: Florida

In the broadcast, students will learn how The Nature Conservancy uses prescribed fire not only to control fuels buildup near populated areas but also to promote the health of the Lake Wales Ridge ecosystem.

As students watch the prescribed burn, have them note some of the precautions taken by the burn boss and his crew both before and during the burn. For instance, students might note that the crews carefully check: the weather forecast, wind speeds, the humidity, soil moisture, the types of plants and the amount of moisture in them, and the location of buildings.

Activity: Fuel Control—Difficult Choices

This activity aligns with the following National Science Education Standards:
Content Standard F: Science in Personal and Social Perspectives—Natural hazards; Risks and benefits; Science and technology in society

Scientific experiments on fuel control methods can be conducted in a laboratory. Scientists also set up controlled studies in the field to help answer questions. Such experiments and studies can help them determine the best ways to control buildup of fuels. Even so, the human element in any situation complicates the picture. When science and society interact, choices are never clear-cut.

In the following activity, students will role-play citizens in a community located in a wildland area. The land management agency has alerted community leaders that an excessive buildup of fuels is threatening the natural area. Should a wildland fire erupt, the welfare of the community could be in jeopardy as well.

Procedure

1.Present the following hypothetical situation to the class:
A huge buildup of fuels is creating a hazardous situation in the wildland area surrounding the community. Local land managers are recommending that, with the very dry weather in the region, the threat of fire is extreme. The fuel load needs to be reduced, and action needs to be taken quickly. The community has its concerns as well.
2. Divide the class into three groups.
3. Assign one group of students to research each of the following methods of fuel control: mechanical, biological, and prescribed fire. Ideally, you could give students several days in which to conduct their research and prepare reports for the class.
4. For the group presentations, give each group a set amount of time to report on its control method, and then allow time for questions and discussion. Hold a class debate on the best approach(es) to take in response to the imaginary situation described above.

Here are some questions students might want to consider about the different fuel treatment methods:

Mechanical treatment: Who will conduct the removal? Who will benefit? How much should be removed? Will roads have to be built into forested areas to conduct the removal operation? Will living trees, dead trees, or both be removed? What vegetation will remain? What are some of the ways that this method can result in a healthier ecosystem?

Biological treatment: What kinds of animals will be used? If insects are used, what

Activity: Fuel Control—Difficult Choices (continued)

guarantees are available that they won't spread beyond the treated area? What about other animals—domestic or wild—that depend on plant life in the area? Can ranchers be paid for providing their stock to perform this service? What are some of the ways that this method can result in a healthier ecosystem?

Prescribed fire: What risks are involved if the prescribed fire gets out of control? Could smoke from the fire pose a hazard to nearby communities? What benefits could a low-burning, carefully controlled fire provide for the ecosystem?

5. Following the debate, hold a vote on which method(s) the community should support in this situation. Students should keep in mind that the best approach may involve using more than one fuel control method.

The Wildland-Urban Interface

Increased awareness of the benefits of wildland fire has coincided with a dramatic increase in the population of the West. Population increases in some regions have pushed subdivisions right to the edge of natural areas. The wildland-urban interface is anywhere that homes exist among flammable vegetative fuels. These areas present particular challenges to firefighters and to anyone responsible for ensuring the safety of the public. Homes become a possible fuel source and the potential for human-caused ignition of fire increases.

Three features characterize the wildland-urban interface:
1. Wildland fuels—trees, shrubs, and other vegetation
2. Urban fuels—homes, landscaping plants, other flammable household materials
3. Limited fire protection resources.

Viewers of the broadcast will see several examples of wildland-urban interface areas—in Colorado, Arizona, and Florida. They will hear about some of the dangers created when fuels build up near communities. They will witness homes destroyed by fire and some that escaped the flames. When fire strikes a wildland area near human-built structures, the first goal of firefighters is to prevent loss of life. But firefighters also make every effort to protect homes, office buildings, and other community resources. They cannot do it alone, however.

While people can never fully protect their homes from wildland fires, they can take actions before fires start to reduce the risks—another important part of fire mitigation. Creating "defensible space" around a home is one way to protect property from the threat of wildland fire. Using "FireWise" practices can also help. Homeowners can:

- Use fire-resistant building materials, especially on the roof;
- Build homes on flat land, not on slopes, and make sure that wooden decks do not overhang a slope;
- Clear vegetation and all flammable materials, including firewood, at least 10 m (30 ft) away from home;
- Provide appropriate space between plants and remove lower branches from trees;
- Install nonflammable screens on chimneys and burn barrels;
- Clean leaves, pine needles, and other flammable debris from gutters;
- Ensure that there is easy access to a nearby water supply (such as a fire hydrant or swimming pool); and
- Make sure that emergency vehicles can access the street and the home and can see the home address from the street.

Activity: Little House Near the Wildlands

This activity aligns with the following National Science Education Standards:
Content Standard F: Science in Personal and Social Perspectives—Natural hazards; Risks and benefits

Materials needed

Copies of illustration on the following page (1 for each student)

Procedure

1. Distribute copies of the “Little House” illustration to the class.
2. Tell students to find and color as many hazards near the house as they can find. (Among the hazards students might note are: the hole in the chimney; leaves and branches on the roof; logs stacked near the house; gasoline near the house; car, tall grasses, and weeds near the house; debris in the yard; tree hanging over the roof.)
3. Discuss with the class ways in which the homeowner could make the home more FireWise.

Activity: Little House Near the Wildlands (continued)

Activity: Risks and Benefits—Personal Decisions

This activity aligns with the following National Science Education Standards:
Content Standard F: Science in Personal and Social Perspectives—Natural hazards; Risks and benefits

Making decisions about risk is never easy. With what they have learned about the risks associated with living in a wildland/urban interface area, have students make some educated decisions about where they would build a home in such a region.

Procedure

1. Make a copy of the aerial map (next page) of a fictional wildland/urban interface region for each student.
2. Discuss with students what the term wildland/urban interface means. Have students look at the map and identify houses that are built in that area.
3. Next, have students look carefully at the map and indicate where in the area they would like to build their home.

1. Have each student write a detailed description of what his or her home would look like. Make sure a list of FireWise techniques is included in the building plans. If time allows, students could also include illustrations of their wildland homes.
2. They should also include reasons why they chose the location they did.
3. Ask for a few students to volunteer to have their choices and plans assessed by the class for survivability in the event of a fire. Among the factors the class should use in their assessments are:
    - Is the house located near a source of water?
    - Is it located on a road wide enough for fire equipment?
    - Are alternate escape routes available?
    - How close is flammable vegetation? What about other flammable materials?
    - What materials are used to construct the home? the roof?

This activity is adapted with permission from the Project Learning Tree Activity Guide, *Exploring Environmental Issues: Focus on Risk,* Activity # 7, “Decision Making: Managing Wildfire Risk.” Permission to adapt should not be interpreted in any way as an endorsement of this adaptation by the American Forest Foundation/Project Learning Tree. The complete Project Learning Tree Activity Guide can be obtained by attending a Project Learning Tree workshop. For more information about Project Learning Tree, please visit the organization’s national website at: www.plt.org.


Aerial Map
– Trees
– Commercial buildings
KEY
– Homes
– Major roadways
– Body of water

Activity: Taking Risks—A Decision Matrix

This activity aligns with the following National Science Education Standards:
Content Standard F: Science in Personal and Social Perspectives—Natural hazards; Risks and benefits

In making decisions about risk, it helps to be able to think critically about the issues at hand, to identify and organize factors involved, to understand uncertainties, and to recognize tradeoffs. In the following activity, students review actions that people can take to reduce the risks of wildland fires. Which option people choose depends on the costs and benefits associated with the option, on individual values and risk perceptions, and on individuals' knowledge about risks and their surroundings.

Procedure

1. Divide the class into groups of 4-5 students and give each group one copy of the "Wildfire Decision Matrix."
2. Explain that each group must decide, given multiple options, which course of action should be taken to reduce the risk of wildfire damage.
3. First, students should make a list of options (alternatives) for reducing the risk of wildfire damage to their home—for instance, fireproofing the roof or clearing vegetation from around the house. (For more ideas, see the "FireWise" list on page 34 or check the following website: www.firewise.org).
4. Students should then make a list of important considerations (criteria) that will help them decide which option to choose (for example, degree of safety it will offer or cost of implementation).
5. One group member should fill in the headings of the chart using the lists of alternatives and criteria that their group developed (as in sample chart below).
6. Next, the group should discuss and then rank the list of criteria in order from highest (most important) to lowest (least important). For instance, if four criteria are listed, they should be ranked in order from 1 (least important) to 4 (most important).
7. To assign each criterion a weighting factor, students should divide the rank by the sum of the ranks. In the example below, the sum of the ranks is 10 (1+2+3+4=10). The weight of a criterion ranked 3 would be 3/10=0.3.
8. Then students should assign a rating factor to each combination of a risk reduction option plus a criterion, with 10 being the highest possibility and 1 being the lowest. (In the sample, the possibility that "building a pond" will help maximize "scenic beauty" is given a rating factor of 8.) Rating factor numbers can be repeated.

9. Next they should multiply the rating factor (rf) by the weighting factor (w) for each combination. The answers should go in the appropriate cell of the decision matrix.
10. Finally, the group should add the products (rf x w) for each risk reduction option and enter the total. The option with the highest value is the option to pursue.
11. Have each group present its results to the rest of the class.

Once presentations are complete, hold a class discussion on the usefulness of this decision-making tool. Among questions the class might consider are:

- Whether the tool was able to take into account enough or too many personal values in making decisions.
- Whether the tool would be useful in a community decision-making situation—for instance, a zoning commission or homeowners association.

This activity is adapted with permission from the Project Learning Tree Activity Guide, *Exploring Environmental Issues: Focus on Risk,* Activity # 7, "Decision Making: Managing Wildfire Risk." Permission to adapt should not be interpreted in any way as an endorsement of this adaptation by the American Forest Foundation/Project Learning Tree. The complete Project Learning Tree Activity Guide can be obtained by attending a Project Learning Tree workshop. For more information about Project Learning Tree, please visit the organization's national website at: www.plt.org.

FOR THE TEACHER
Table 3. Sample Wildfire Decision Matrix

Selection Criteria →	Maximize Safety of House	Maximize Scenic Beauty	Minimize Economic Impact	Minimize Ecological Impact	Total Score
Alternatives ↓	rank = 4 weight = .4	rank = 2 weight = .2	rank = 1 weight = .1	rank = 3 weight = .3	
Move to less scenic, low-risk location	rf = 10 rf x w = 4	rf = 3 rf x w = .6	rf = 4 rf x w = .4	rf = 2 rf x w = .6	(4 + .6 + .4 + .6) = 5.6
Build pond	rf = 6 rf x w = 2.4	rf = 8 rf x w =1.6	rf = 5 rf x w =.5	rf = 6 rf x w =1.8	(2.4 + 1.6 + .5 + 1.8) = 6.3
Buy fire insurance	rf = 2 rf x w = .8	rf = 10 rf x w = 2	rf = 3 rf x w = .3	rf = 10 rf x w = 3	(.8 + 2 + .3 + 3) = 6.1
Fireproof roof and sides of house	rf = 7 rf x w = 2.8	rf = 5 rf x w = 1	rf = 3 rf x w = .3	rf = 8 rf x w = 2.4	(2.8 + 1 + .3 + 2.4) = 6.5
Clear trees	rf = 8 rf x w = 3.2	rf = 3 rf x w = .6	rf = 5 rf x w = .5	rf = 7 rf x w = 2.1	(3.2 + .6 + .5 + 2.1) = 6.4
Build pond and clear trees	rf = 9 rf x w = 3.6	rf = 7 rf x w =1.4	rf = 4 rf x w =.4	rf = 5 rf x w =1.5	(3.6 + 1.4 + .4 + 1.5) = 6.9

rf = rating factor   w = weight

Source: Decision matrix methodology adapted from Iozzi, Louis A., and Peter J. Bastardo. *Decisions for Today and Tomorrow.* Longmont, CO: Sopris West, Inc. 1987.

Wildfire Decision Matrix

Circle one: Individual/Community

Selection Criteria →								Total Score
Alternatives ↓	rank = weight =	rank = weight =	rank = weight =	rank = weight =	rank = weight =	rank = weight =	rank = weight =	
	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	
	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	
	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	
	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	
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	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	rf = rf x w =	

w = weight (rank divided by the sum of the rankings)
rf = rating factor (on a scale of 1–10, the possibility that a specific alternative will help achieve the specified criterion)
total score = sum of the **rf x w** for each alternative

Activity: Taking Action—A "FireWise" Assessment

This activity aligns with the following National Science Education Standards:
Content Standard F: Science in Personal and Social Perspectives—Natural hazards; Risks and benefits

If you live in a fire-prone area, perhaps your students could perform a "FireWise" assessment of the school or some other public building in your community. Use the following checklist or develop your own with the help of the FireWise website (www.firewise.org):

- ( ) The roof is made of fire-resistant materials.
- ( ) Vegetation is cleared at least 10 m (30 ft) from the structure.
- ( ) Any openings (such as vents of fireplace chimneys) have a nonflammable screen.
- ( ) Tree limbs do not overhang the roof.
- ( ) There is space between plants and lower branches of trees (ladder fuels) have been removed.
- ( ) There is easy access to the structure for fire trucks.
- ( ) There is easy access to a nearby water supply (such as a fire hydrant or swimming pool).
- ( ) The structure is not on a slope, and wooden decks do not overhang a slope. (Even slight slopes can accelerate the spread of fire.)
- ( ) Gutters are clear of leaves, pine needles, and other flammable debris.
- ( ) Exterior surfaces of the structure are fire resistant.
- ( ) Flammable materials are at least 10 m (30 ft) from the structure.

Extension:

Even without undertaking an on-site assessment, your class could still perform a valuable public service by preparing posters, brochures, or fliers to inform the community about FireWise practices. Perhaps you could arrange for a display at your local library or other public facility.

Activity: Taking Action Now ...and in the Future

This activity aligns with the following National Science Education Standards:
Content Standard F: Science in Personal and Social Perspectives—Natural hazards; Risks and benefits
Content Standard G: History and Nature of Science—Science as a human endeavor

Throughout the country, students have been involved in community service projects related to FireWise assessments. Evaluating public buildings or helping homeowners learn more about FireWise techniques are both valuable projects. Elderly homeowners might be grateful for even more assistance in making their homes safer.

Working to restore areas that have burned is another opportunity for students to engage in community service. Student volunteers can get involved in rehabilitation projects, for example—from planting grasses and trees to pulling weeds.

In fire-prone areas, your class can also engage in research projects that assist scientists in the study of fire and its effects. Such research can be of value not only to scientists but also to science students, who learn by doing. To cite but a couple of examples, students could conduct species inventories before and after a prescribed burn. They could prepare and monitor test plots to help determine how a particular method of fuels treatment affects fire behavior. To explore possible opportunities in your area, contact one of your local land management agencies.

Students might also be thinking about pursuing a fire-related career in the future. Growing up to be a firefighter is certainly not the only option available. A review of the “Meet the Players” section of this guide could provide them with some insights into the variety of opportunities that exist in the field. To whet their interest even further, consider inviting a fire specialist to come speak to your class.

Appendices

Visit the Places

Colorado

During the summer of 2002, more than 200,000 hectares (500,000 acres) of land burned in the state of Colorado. A dry winter and spring, along with tremendous fuels buildup in many locations, contributed to the severity of the fire season in the state. In southwestern Colorado, Nucla-area students experienced the impact of fire firsthand, when a fast-moving fire struck an area known as Burn Canyon in July. Extremely dry fuels, wind, and the steep terrain were all factors in the rapid growth of the fire, which exploded over 3,000 hectares (8,000 acres) in just one night. Before it was over, more than 12,000 hectares (30,000 acres) burned in the rugged canyon where vegetation consists primarily of ponderosa pine, oakbrush, sagebrush, and pinon-juniper.

Viewers will hear from Nucla High School students and will also learn how other Colorado students are helping homeowners with fire mitigation. Fire is a natural process, but as the students reveal, homeowners play a key role in protecting lives and property. Firefighters cannot do it alone.

Florida

Lake Wales Ridge is an ancient sand dune that extends about 150 km (100 mi) north and south down the middle of the Florida peninsula—about an hour's drive south of Disney World. Some two million years ago, this ridge was the only piece of dry land around. This isolation contributed to the evolution of numerous plants and animals that can only be found in this particular region today. The isolation of these "endemic" species ("endemic" means native or restricted to a particular area) also increases the chance that some of them will have trouble surviving. And in fact, 26 species of plants and animals that live on the Ridge are listed as endangered or threatened by the federal government.

In order to protect this special habitat, more than 30 conservation sites have been established along the Ridge. These sites are managed by a variety of agencies and organizations, such as state and federal natural resources agencies, and private organizations such as The Nature Conservancy. The broadcast takes viewers to one such site managed by The Nature Conservancy where prescribed fire is being used to restore the scrub habitat the characterizes the area.

Scrub consists of shrubs, dwarf oak trees, scattered pines, and other low-growing plants. Bright, open patches of bare sand are scattered throughout the scrub. Scrub plants and animals have adapted to thrive on regular lightning-caused fires. The Florida scrub-jay, for instance, needs the scrub to be at a particular height and density. If the scrub is too open, the jays will be vulnerable to predators like hawks. If the scrub is too dense, the birds will not have open patches of bare sand to store acorns. Historically, periodic fires helped to maintain these conditions. But when people moved into the area and began suppressing fires, the habitat started to change. The scrub became too dense. The Florida scrub-jay is now a threatened species.

The Nature Conservancy, as seen in the broadcast, is using prescribed fire as one tool to restore the scrub habitat for animals such as the scrub-jay. Prescribed fire is also used to reduce fuel levels and thus avoid very intense, hot fires. Such fires not only improve habitat for plants and animals, but also protect nearby homes from the threat of fire caused by fuels buildup.

As viewers will note, extensive planning is done before a prescribed burn takes place. For example, fire experts use satellite maps that show all the plant communities, previous burn locations, and the surrounding area. They monitor fuel moisture, soil moisture, relative humidity, as well as wind speed and direction both before the fire is ignited and while the burn is taking place. As The Nature Conservancy experience in Florida demonstrates, prescribed fire can be an important land management tool when carefully planned and conducted.

Arizona

BLM's National Training Center, where the broadcast originates, is located in Phoenix, Arizona. In the summer of 2002, Arizona was also the site of a huge fire that actually began as two separate fires. Before it was over, the Rodeo-Chediski fire burned nearly 200,000 hectares (470,000 acres) and became the largest fire in the history of the Southwest.

The broadcast takes viewers to two areas affected by the Rodeo-Chediski fire to witness how fuel treatments can make a difference when fire burns through an area. Homeowner Pam Wiggins lives in Overgaard, Arizona, about 250 km (150 mi) northeast of Phoenix. She represents an increasingly common phenomenon in the West—a resident of a wildland-urban interface area. In the broadcast, Pam describes the actions she and her family took to protect their home before the Rodeo-Chediski Fire began moving through their subdivision. In this case, fire mitigation paid off. The flames actually slowed and stopped burning as they came into her yard.

Just south of Overgaard lies the Fort Apache Indian Reservation of the White Mountain Apache Tribe. For decades, the Fort Apache Agency of the Bureau of Indian Affairs has been conducting forest management and fuels treatment in this area. Viewers will be able to see up close how areas treated by thinning and prescribed burning were much less severely affected by the Rodeo-Chediski fire than untreated areas. The fire raged through the untreated forest, while just up the road, the treated areas remained green and productive.

National Interagency Fire Center, Boise, Idaho

The National Interagency Fire Center (NIFC) is the nation's support center for wildland firefighting. Seven federal and state agencies work together there to coordinate and support wildland fire and disaster operations. To help facilitate effective firefighting and disaster management, equipment and personnel are shared. But there's more to managing fires than fighting them. Education is an important part of NIFC's mission as well.

In the broadcast, viewers will tour NIFC to learn how the latest technology is used in fighting fires—from sophisticated handheld radios to Remote Automated Weather Stations to infrared aircraft. They'll meet some of the many people involved in firefighting operations—everyone from dispatchers to equipment developers to smokejumpers.

Meet the Players

From Washington, D.C.

Gale Norton, Secretary of the U.S. Department of the Interior, introduces the satellite broadcast. Ms. Norton is the first woman to head the 153-year old department. During her 25-year career, she has served in many posions in Washington D.C. and in her home state of Colorado. She has made what she calls the *Four C's* the cornerstone of her tenure: Consultation, Communication, and Cooperation, all in the service of Conservation. At the heart of the *Four C's* is the belief that for conservation to be successful, the government must involve the people who live and work on the land.

Student Hosts

Rachel Durland is a junior at Boise High School where she maintains an A average. Her scholastic interests include writing and science. She is co-hosting with her dad from the National Interagency Fire Center in Boise.

Cody Lee Calamaio is a sophomore at Horizon High School in Phoenix. She is a member of the Top 100 Club for academic achievement, as well as the Society of Women Scholars. Her interests include all types of music and video production. She is co-hosting with her dad from the BLM Training Center.

Kaiden Spurlock is a 10th grade home school student from Frostproof, Florida. He has attended prescribed fire courses that enable him participate as a crewmember on burns. He is co-hosting from Lakes Wales Ridge in Florida.

Student Reporters

Ashley McCllelan from Nucla High School, Nucla, Colorado
Anthony Evans from Centennial Junior High School, Montrose, Colorado
Jimmy Lawson from Centennial Junior High School, Montrose, Colorado
Andrew Crandell from Mogollon High School in Heber, Arizona
Jessica Tenney from Mogollon High School in Heber, Arizona

Live from Phoenix, Arizona

Chip Calamaio is BLM's Senior Producer/Director and Manager of the BLM Satellite Network at the National Training Center in Phoenix, and host for this show. As a specialist in instructional television since the 1970's, Chip worked at the high school, post-secondary, and university levels as an instructional developer with the Bureau of Indian Affairs as well as the University of New Mexico. The national BLM media team he leads works on a wide variety of adult education projects across all areas of natural resource management.

Thomas Lund, Fire Mitigation & Education Specialist for BLM's Arizona Strip office, graduated from Dixie College in 1987 and went on to Utah State University. He started his fire management career in 1981, working as a helitack crewmember. He held varied positions over the next several years—on an engine crew and on type-two hand crews as well as a helicopter manager and dispatcher—gave him the extensive experience he needs for his current position.

Dena Sprandel, a BLM Fire Mitigation and Education Specialist from Miles City, Montana, has been involved in wildland fire for 10 years. As a firefighter, she has served on engine and helitack crews and was an Engine Foreman and an Aviation and Initial Attack Dispatcher. She has a B.S. in Elementary Education from Montana State University. In her current position, she serves on fire duty when needed and also works with local rural fire departments, homeowners, and educators on a variety of fire issues.

Phoenix Studio Audience

Keith Blackman's 8th grade science students from the Stetson Hills School are the participants in the first broadcast.

Mike Vacchina's 7th grade science students from OLPH School are the participants in the second broadcast.

Live from NIFC, Boise, Idaho

Pat Durland, who is co-hosting the show from NIFC, is the national wildland fire education and wildfire prevention specialist for the BLM and the Department of the Interior. His responsibilities include wildland fire prevention and education, and wildland/urban interface fire protection. Pat graduated from the University of Idaho in Forest Resource Management. Over more than 25 years, his career has included aviation management, fire management planning, prescribed fire administration, wildland fire prevention and education, and 10 seasons as a wildland firefighter. He has been involved in international wildland fire assignments in Canada, Honduras, and New Zealand.

Live from Lake Wales Ridge, Florida

Reed Bowman is a research biologist and head of the Avian Ecology lab at Archbold Biological Station. He holds graduate degrees in wildlife and biology from McGill University and the University of South Florida. Over the last 20 years he has studied the ecology, demography, and conservation of several threatened and endangered birds, including the white-crowned pigeon, the red-cockaded woodpecker, and the Florida scrub-jay. He is the author of more than 40 scientific papers and book chapters and the editor of two books, including the recently published "Avian Ecology and Conservation in an Urbanizing World."

Mary Huffman, who is co-hosting the show from Florida, is the program director for The Nature Conservancy at Lake Wales Ridge, where she guides operations to ensure the long-term protection of the area's biological diversity. Mary earned her undergraduate degree from University of Montana and her M.S. in botany from Miami University. She coordinates land management efforts with the 15 private and public partners working on Lake Wales Ridge, and serves as a member of the Conservation Team, a prescribed fire leader, and the Conservancy's diversity awareness trainer for the Florida region.

Steve (*Sticky*) Morrison is the Preserves Manager for The Nature Conservancy. Thirteen years ago Steve Morrison joined the staff of The Nature Conservancy to work on preserving the natural ecology of the Lake Wales Ridge. He is responsible for management activities on six preserves including fire management, boundary protection, habitat restoration, exotic species control and biological monitoring. After a dozen years of carefully applying fire to the ecosystem, he is still fascinated by and in awe of this natural process. He is nicknamed "Sticky" for his bee-raising hobby.

Kathy Jaworski is a member of The Nature Conservancy's Senior Fire Strike Team Crew, where she is starting her second year on an initiative designed to restore fire to Florida scrub-jay habitat. Kathy received a B.A. degree in environmental science in 1999. She worked for the U.S. Forest Service as a forestry technician in Arizona and participated in Americorps as a field intern at the Edwin B. Forsythe National Wildlife Refuge in New Jersey.

Tabitha Biehl, County Land Manager, is responsible for developing ecological management plans and conducting land management duties on six county properties. Her duties include fire management, fire planning, resource inventory, biological monitoring, habitat restoration, and mapping. She gained field experience as a field technician at Purdue University and during a summer internship as a restoration specialist for The Nature Conservancy's Indiana Chapter. Tabitha holds a B.S. in wildlife biology from Purdue University.

Lake Wales Ridge Burn Crew

Chris Ward (holding boss)
Walt Thomson (crew)
Adam Peterson (engine boss)
Al Biscup
Erin Schumacher
Jana Mott (ignition specialist)

From Colorado

Bill Godsil's Social Science class, Centennial Junior High School, Montrose
Denise Sandefur's Environmental Science Class, Nucla High School, Nucla
Jessica Dumke's, 7th grade science Telluride Middle School, Telluride

From Arizona

Robert Vataha is a supervisory dispatcher for the Fort Apache Agency, Bureau of Indian Affairs (BIA) in Whiteriver, Arizona. In 1973 he began working for the BIA as a timber sales officer, and has worked in timber sales planning, growth and management, forest development, and timber stand improvement. He has been a prescribed fire burn boss since 1985, and in 1987 transferred to the fire management section, where he has conducted prescribed burning in all the major ecosystems of northern Arizona. Robert is an enrolled member of the White Mountain Apache Tribe.

Behind the Scenes

Bibi Booth, educational specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the purchase and distribution of the educational materials for the program.

Carolyn Cohen, education specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the marketing and promotion of the program and served as an assistant producer for the broadcast.

Julie Decker, renewal resources group supervisor at BLM's National Training Center in Phoenix, served as a technical producer for the show.

Art Ferraro is the Director of the live broadcast. He is a Producer/Director for the BLM National Training Center, serves as the media department's Technical Director, and will be directing a cast and crew of more than 50 people in three states for this telecast.

Kevin Flynn, the web editor for BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated all web-related materials for the program and designed the Educator's Guide.

Venetia M.Gempler is a Public Affairs Specialist for the BLM at the National Interagency Fire Center (NIFC) in Boise, Idaho. She coordinated production of the NIFC Live Remote and constructed the Firewise Challenge miniature house.

John Guerrero is a Producer/Director for BLM's Satellite Network, at the National Training Center in Phoenix, Arizona. He produced the Colorado mitigation and Florida tape segments and the live telecast from Florida.

Jennifer Kapus, graphic designer for BLM's National Science and Technology Center in Denver, Colorado, designed the logos and artwork for the set, and promotional and educational materials.

Alma Lively, produced the Colorado fire testimonial, the Arizona Rodeo Chediski segments and coordinated the graphics for the live telecast. She is a Producer/Director with the BLM National Training Center in Phoenix.

Tricia Martin, Director of Community Relations for the Lake Wales Ridge program of The Nature Conservancy, organized and coordinated the Conservancy's role from the Florida site.

Maggie McCaffrey, a fire education specialist for BLM in Montrose, Colorado, coordinated the student activities presented in the Colorado segment.

Kim Menning is a Video and Television Producer/Director at BLM's National Training Center in Phoenix, Arizona. She is the Crewing Coordinator and the remote producer for the live telecast from Boise.

John Owens, Fire Education Specialist, BLM, National Interagency Fire Center, Boise, Idaho, coordinated and wrote educational content.

Elizabeth Rieben is the producer of the show. She is an education specialist and writer for BLM's Environmental Education and Volunteers Office in Washington, D.C.

Mary Tisdale is an executive producer of the show. She manages BLM's Environmental Education and Volunteers Office in Washington, D.C.

Betsy Wooster, education specialist in BLM's Environmental Education and Volunteers Office in Washington, D.C., coordinated the content of the website and the Educator's Guide.

An Important Cautionary Note

Many young people are often tempted to play with fire. In discussing fire with your students, it is critical to emphasize safety and the importance of adult supervision. A small percentage of young people who have been educated about the dangers of fire may persist in setting fires. These children pose a real danger to themselves, their families, and their communities.

Fire setter prevention programs throughout the country seek to educate young people on the dangers of fire setting and to hold them accountable for their actions. The programs also train fire service, law enforcement, juvenile justice, mental health, schools, and social service personnel in evaluation and intervention strategies. Teachers who suspect a child may be a fire setter can work with parents and the local fire department to find resources in the community.

Here are some steps that can be taken immediately by parents and teachers:

- Make sure working smoke detectors are installed in your home and school.
- Have a home and school escape plan and practice it.
- Lock up all matches and lighters.
- Establish a clear rule that the child is never to have matches or lighters.
- Increase supervision of the fire-setting child.
- Check any secret hiding places where matches might be hidden.
- Lock up all flammable liquids.
- Watch your own actions and always be responsible when using fire. Children imitate adults.
- Contact your local fire department for more information.

For more information on the Colorado Juvenile Firesetter Prevention Program, see the following website: www.state.co.us/gov_dir/cdps/FireSafety/ProgServ/cjfsp.htm

Safety Rules for the Classroom

Some of the activities in this booklet involve using matches and fire. We strongly encourage you to perform these as demonstrations rather than allowing students to conduct them. Make sure you and your students follow the safety rules listed below:

- Students should be kept away from burning materials and hot liquids.
- Wear safety goggles.
- Keep fire extinguishers close at hand. Make sure everyone knows where they are and how to use them.
- Water and sand can both be used to extinguish a fire. These items should be available.
- Make sure everyone is aware of the evacuation plan for your room and your school.
- Be aware of students who have asthma or allergies to smoke. They should wear breathing apparatus or observe from a safe distance.

Glossary

backfire: a fire set downwind along a firebreak

crown fire: a fire that burns primarily in the leaves and needles of trees, moving quickly from treetop to treetop.

defensible space: an area either natural or manmade where material capable of causing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and the loss to life, property, or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

duff: the layer of decomposing organic materials lying below the litter layer of freshly fallen twigs, needles, and leaves and immediately above the mineral soil.

fire dependence: a characteristic of plants or plant communities that rely on fire as one mechanism to create the optimal situation for their survival.

fire ecology: the study of the role of fire in nature

fire history: the chronological record of the occurrence of fire in an ecosystem.

firebreak: a natural or man-made line or area where fuels are limited or nonexistent. Firebreaks are sometimes constructed to stop or slow the spread of fire.

fuel: any dead or living material that will burn. This includes grasses, dead branches and pine needles on the ground, as well as standing live and dead trees. Also included are minerals near the surface, such as coal that will burn during a fire, and human-built structures.

fuel load: the amount of combustible material (living and dead plants and trees) that is found in an area.

ground fire: a fire that burns organic materials in the soil layer (e.g., peat) and often the surface litter and low-growing vegetation.

infrared detection: the use of heat sensing equipment, known as Infrared Scanners, for detection of heat sources that are not visually detectable by the normal surveillance methods of either ground or air patrols.

ladder fuels: fuels that provide vertical continuity between strata, thereby allowing fire to move from surface fuels into the crowns of trees or shrubs with relative ease. They help initiate and assure the continuation of crowning.

litter: The dead debris, including pinecones, pine needles, branches and other material, that covers the ground in a forest or shrub area. This term usually applies to material that has not begun to decompose.

mitigation: an action taken to reduce or limit losses.

prescribed fire: the planned application of fire to natural fuels, including logging debris, grass-lands and/or understory vegetation, with the intent to confine the fire to a predetermined area. A prescribed natural fire refers to allowing naturally ignited fires, such as those started by lightning, to burn under specific management prescriptions without initial fire suppression.

Remote Automatic Weather Station (RAWS): an apparatus that automatically acquires, processes, and stores local weather data for later transmission to a satellite, from which he data is re-transmitted to an earth-receiving station for use in the National Fire Danger Rating System.

serotinous: a pinecone or other seed case that requires heat from a fire to open and release the seed.

snag: a standing dead tree.

spot fire: a fire ignited outside the perimeter of the main fire by flying sparks or embers.

succession: the gradual replacement of one plant and animal community by another.

wildfire: any fire occurring on wildlands that is not meeting management objectives and thus requires a suppression response.

wildland fire: any fires that burn in wildlands, including wildfires and all prescribed fires.

wildland-urban interface: areas where human communities are built in close proximity to flammable fuels found in wildlands.

Resources

General

Burning Issues (grades 5–10). U.S. Department of the Interior, Bureau of Land Management, and Florida State University. This CD-ROM offers interactive multimedia lessons on fire ecology and fire management, including fire management simulations. The CD also contains the student and teacher educational guides (http://fsu.edu/~imsp).

Fire Ecology Resource Management Education Unit (grades 4–8). Interagency Fire Education Initiative. Ecology Communications Lab, School of Natural Resources, Ohio State University. This unit contains activities developed to help students become better informed about fire and land management issues, as well as background information on fire ecology. It is available on the web (http://www.nps.gov/fire/fire/ecology/docs/toc.html).

Fire Education Team Publications and Materials from the U.S. Department of the Interior, U.S. Department of Agriculture, and National Association of State Foresters. Products available include activity books, cards, stickers, games, posters and other materials for grades levels from Pre-K through adult. (http://www.symbols.gov/catalog/products/fire_welcome.html):

FireWorks Curriculum (grades 1–10). Jane K. Smith and Nancy E. McMurray. 2000. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. General Technical Report RMRS-GTR-65 (www.fs.fed.us/rm/pubs/rmrs_gtr65.html).

Project Learning Tree Fire Education Materials. (Pre-K–12). American Forest Foundation. PLT is an award-winning, interdisciplinary, environmental education program. PLT has materials on forest management and fire ecology for grades Pre-K through high school, including: *Pre K–8 Environmental Education Activity Guide; The Changing Forest: Forest Ecology Secondary Module; and Exploring Environmental Issues: Focus on Risk Secondary Modules* (www.plt.org):
Smokey Bear. Variety of Smokey Bear fire prevention materials are available from many wildland firefighting groups. Information is also available on the Smokey Bear website (www.smokeybear.com)

The Colorado Fire Box: Activities for Understanding Wildland Fire (grades 6–12 and adults). Greater Arkansas River Nature Association, P.O. Box 1522, Salida, CO 81202 (719) 539-5106, info@garna.com.

Websites

There are many sites that contain fire ecology and wildland-fire-related information. Those listed here provide a good source of basic information and also have links to a number of other sites.

- National Wildland/Urban Interface Fire Program

www.fire.blm.gov - Bureau of Land Management Fire and Aviation
www.nps.gov/fire - Fire in the Parks, National Park Service
www.fs.fed.us/fire - USDA Forest Service Fire Management
www.fs.fed.us/database/feis - Fire Effects Information
www.nifc.gov - National Interagency Fire Center
www.tncfire.org - Nature Conservancy Fire Initiative
www.plt.org - Project Learning Tree

Fire Mapping

The Geospatial Multi-Agency Coordination Group (GeoMAC), is an internet-based mapping tool originally designed for fire managers to access online maps of current fire locations and perimeters in the conterminous 48 States and Alaska. Using a standard web browser, fire personnel download this information to pinpoint the affected areas. With the growing concern of western wildland fires in the past several years, this application also became available to the public. Students and teachers can access GEOMAC to track wildfires. The site is used primarily during the fire season and may not be fully functional during winter months. The web address is: www.geomac.gov

Share the Adventure!
Exploring Wildland Fire Evaluation Form

The first 100 educators to complete and return this evaluation form will receive a free CD on fire and fire management entitled “Burning Issues,” a $25 value. For information on the CD and a sample activity, visit the following website: http://fsu.edu/~imsp/

Name____
School ____
Address ____
City, State, Zip Code ____

Audience________________________

Number of students viewing the broadcast___________

Grade levels in audience__________

Students live in an area that is (check one or more) ____ urban ____ suburban ____ rural

Please rate the following from 1 (poor) to 5 (excellent), with 0 meaning “not applicable”:

Technical	Poor----------------------Excellent------N/A					
1. Overall quality of satellite feed	1	2	3	4	5	0
2. Video reception	1	2	3	4	5	0
3. Sound reception	1	2	3	4	5	0

Program content and presentation

4. Overall quality	1	2	3	4	5	0
5. Appropriate content for grade level	1	2	3	4	5	0
6 Learning objectives	1	2	3	4	5	0
7. Adult host in studio	1	2	3	4	5	0
8. Student hosts	1	2	3	4	5	0
9. Phoenix studio segments	1	2	3	4	5	0
10. NIFC remote segments	1	2	3	4	5	0
11. Florida remote segments	1	2	3	4	5	0
12. Colorado segments	1	2	3	4	5	0
13 Set design	1	2	3	4	5	0
14. Length of program	1	2	3	4	5	0

15. Did you view this program ____ live ____videotape?
16. Did you view the bonus 1/2 hour session? ____yes ____no

Interactivity

17. Live student activities	1	2	3	4	5	0
18. Wildfire Challenge game	1	2	3	4	5	0
19. Q & A session after program	1	2	3	4	5	0
20. Website	1	2	3	4	5	0

Interactivity, Continued

21.	Telephone questions answered on air	1	2	3	4	5	0
22.	Did your class phone in a question? ____ yes ____ no						
23.	Faxed questions answered on air	1	2	3	4	5	0
24.	Did your class fax a question? ____ yes ____ no						

Educator Guide		Poor	---	---	---	Excellent	------N/A
25.	Overall quality of content	1	2	3	4	5	0
26.	Background information	1	2	3	4	5	0
27.	Activities	1	2	3	4	5	0
28.	Appropriate level of activities	1	2	3	4	5	0
29.	Resource list	1	2	3	4	5	0

Follow-up

30. As a result of the broadcast, do you intend to use any of the guide activities in your classroom
____ yes ____ no
If yes, identify which ones (use additional sheet, if needed).

31. Would you be interested in future "Share the Adventure" broadcasts?
____ yes ____ no. If yes, what time of year? _____Fall ____Spring
If yes, please list topics that would interest you.____________________________________
____

33. What were the strengths of the broadcast? ____
____

34. What were the weaknesses of the broadcast?_______________________________________
____

35. Were the learning objectives met?_________________________

36. Which standards were best met (see list on page 10)____________________________________
____

36. What changes could make this a more useful event for future participants?
____

37. What is your overall impression of this broadcast? _________________________________
____

Other comments: ____
____
____

Thank you for completing this evaluation. Please return by mail or fax to:

Bureau of Land Management, Environmental Education and Volunteers Group
1849 C Street NW, MS LS 406, Washington, DC 20240.
FAX Number: 202-452-5199

(Reminder: A free "Burning Issues" CD will be sent to the first 100 educators who return this form!)